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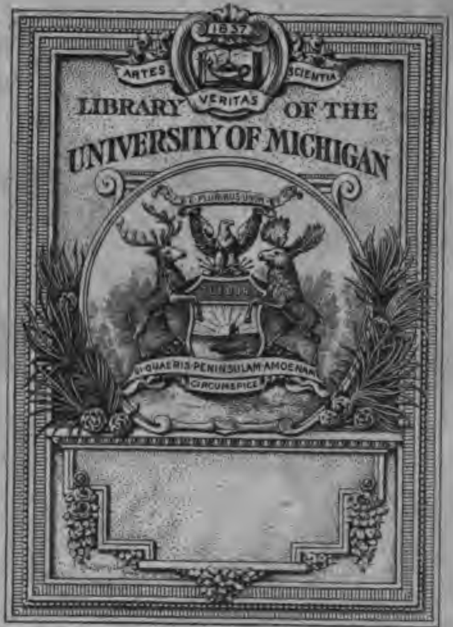
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THE LAWS OF NATURE

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MAN'S POWER TO MAKE THEM SUBSERVIENT TO HIS WISHES.

BY

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INTRODUCTION.

THE present volume is one of a series to be published, and to which the author has given the name of the "*Mott Series.*"

The following volumes will treat on "How we See," "How we Hear," "How we Smell," "How we Taste," "How we Breathe," "What we Breathe," "What we Drink," "What we Eat," etc. Each volume will be a short, clear, and popular description of the subject from a scientific standpoint and brought down to the present day by the application of the facts and truths revealed by science.

In this progressive age every one should be more or less perfectly informed on such important subjects as relate to

Health and Life, and it is for this reason that the author has undertaken to prepare volumes which can be obtained at a price within the reach of all.

The present volume, on "The Laws of Nature," seemed appropriate for the commencement of such a series as has been referred to. The succeeding volumes will be more practical in their nature, but at the same time equally as interesting and instructive.

THE AUTHOR.

NOVEMBER 17, 1882.

THE LAWS OF NATURE,

AND

MAN'S POWER TO MAKE THEM SUBSERVIENT TO HIS WISHES.

The laws of nature are but the transcript of the thoughts of God, immutable and unchangeable.

There is no such thing as Chance. Chance has no existence under the constant laws of nature or under any laws. What is called Chance is only the uncalculated result of some known or unknown law of nature.

Real chance would be motion of some kind from no cause at all, and antecedent to all the laws of nature.

An atheist believes that man is but "*a chance combination of atoms.*" That "*every atom is its own God.*" Let us examine this and see how consistent such a belief is. The proposition is this: Every atom being self-existent, had the power in the beginning to adopt what laws of motion it pleased; so they all, by some mysterious universal suffrage conveyed through the infinity of space, or through the immeasurable sphere of the primeval nebulæ, *mutually agreed* on the law and intensity of gravity, and have steadily kept to their agreement ever since. If this proposition looks absurd, atheists can blame no one but themselves, for the doctrine of inherent forces cannot be translated in plain English in any other way. To talk about "self-contained energy" is to say that a body can both expend energy and yet retain it, and still some men feel perfectly at home with such an idea.

When an atheist or agnostic states positively that he believes in chance, for one reason, and for one only, should the world be pleased, for there is a *chance* that he will eventually believe in God.

An atheist believes in effects without causes. I should think to contemplate such a belief would cause them to smile; perhaps I am wrong—they probably will smile without a cause, to be consistent.

Science positively shows that a power must have existed outside of the visible universe to have distributed the cosmic matter in space unequally before the world was formed, and also to give the first impulse to the matter so distributed which caused its rotation. Call this power a mode of the unknowable, or what you may, I call it "God." An atheist says—When two atoms come together, having an affinity for each other, the result is life. What more is necessary, they ask ? Some power that will cause them to go together, to give them the first push.

They must have had a first push, or else they must have always existed, which science denies. This first push may have been given to the nebulous matter, and held in a potential state, until simple matter became complex, when the potential force would become active. No motion can begin without a force acting in that direction, whereas rest requires none. Atheists do not seem to be interested in explaining how a single particle of matter commenced to move itself, also to combine and produce all sorts of complicated results, which are not even physical but psychical, or belonging to the mind. The reason is simple, they would have to admit the existence of a power or God outside of nature. The atheist Bradlaugh, speaking of God, says: "I know not what you mean by God; I am without idea of God; the word God is to me a sound conveying no clear or distinct affirmation. I do not deny God, because I cannot deny that of which I have no conception, and the conception of which by its affirmer is so imperfect that he is unable to define it to me."

Thomas Cooper said: "I do not say there is no God; but this I say—I know not." It is the opinion of Holyoake that "the only way of proving the fallacy of atheism is by proving the existence of God." Let us see what science can contribute to such proof.

Theories in science are of very great value to deduce explanations for various unsolved problems, but as soon as we discover the correct theory which will explain the problem under consideration in all its details, as known to us, the theory ceases to be a theory and becomes *a law*. In endeavoring to prove the existence of a power outside of the visible world, or, in other words, the existence of God, we have to go about it in the same way as any scientific theory, by showing that such a power or God accounts for all the phenomena which it ought to account for much better than any other theory, and especially where no more than one rival theory is possible; or, in other words, one theory is enormously more probable than the other. How can the absence of experience raise even the smallest presumption against any theory which, if it were ever so certain, does not in the nature of things admit of experimental proof, which the theory of the universe being sustained by persistent exercise of God's power certainly does. We should believe in the existence of this power or God as superior to the visible universe as probable, and much more probable than the opposite view, and so probable that our faculties cannot distinguish between this probability and an absolute certainty.

The arguments cited above in relation to the first impulse show clearly that such a power or God must exist, but there are logical arguments which strengthen the proof.

Cousin maintained in his work on Psychology that the idea of the finite implies that of the infinite as inevitably as the "Me" implies that of the "Not me."

Cousin also calls attention to the true, the beautiful, and the good, and says, "Man is not true, beautiful, or good, there must be an Existence of which truth, beauty, and goodness are attributes."

The ontological argument runs thus: We have an idea of an infinitely perfect being, but real existence is an element of infinite perfection. Therefore an infinitely perfect being exists; otherwise the infinitely perfect, as we conceive it, would lack an essential element of existence. Another argument often used is the Cosmological Argument, which may be stated thus: Every new thing and every change in a previously existing thing must have a cause sufficient and pre-existing. The universe consists of a series of changes. Therefore the universe must have a cause exterior and anterior to itself.

It is evident from the above that it is not from logical reasoning or arguments that the atheist is led to say "that up to this moment the world has remained without knowledge of a God." It is from the folly of his heart; and, as the writer Solomon says, that, "though you bray him and his false logic in the mortar of reason, among the wheat of facts, with the pestle of argument, yet will not his folly depart from him." I fully agree with Hobbes when he says, "Where there is no reason for our belief, there is no reason we should believe." I think, however, the several arguments already advanced, which could be greatly elaborated, afford sufficient reason for a belief in an infinite God. For—

> "God hath a being, and that you may see
> In the fold of the flower, the leaf of the tree,
> In the sun of the noonday, the star of the night,
> In the storm-cloud of darkness, in the rainbow of light,
> In the wave of the ocean, the furrow of land,
> In the mountain of granite, the atom of sand;
> Turn where ye may, from the sky to the sod,
> Where can ye gaze that ye see not a God?"

Yes, the infinite God must include all. If he is not in the dust of our streets, in the bricks of our house, in the beat of our hearts, then he is not infinite, he would have boundaries.

It was God's power that set the nebulous mass into vibration, and caused the world to be formed; it was his force which first shaped the atoms into molecules, and then into more complex chemical products, till finally "organizable protoplasm" was reached, which by evolution climbed up to man. 'Tis God we see in the family, in society, in the state, in all religions.

'Tis Him we see in art, literature, and science, and so proclaims evolution. God is the universal causal law. God *is the source of all force and matter.* All nature is animated, penetrated with Divine Spirit and with law. We know of no matter without this Divine Spirit.

Just as an image is sustained in a mirror by the constant succession of the rays of light, so nature is sustained by the constant forth-putting of the power of God, in whom we live and have our being, and which, if but for an instant withdrawn, the whole universe, in all its vastness, glory, and beauty would sink in a moment into the simple condition from whence it arose.

The advancement of science, instead of depriving man of his God, only deprives men of their earlier and ruder conceptions of Deity, only to impart a larger and grander thought of him. As Henry Ward Beecher has said, "It is true, in the educational process some few minds have lost sight of him altogether, but these are the exceptional and therefore notable instances; with the body of men the conception of God has steadily enlarged with the progress of science." God is the prime cause of everything. It is decidedly wrong to talk about the laws of nature being the cause of anything, they are simply statements of the course of nature or the uniform results of unknown physical causes ending in some prime cause or causes not merely physical, and it is absurd to talk of such results as being themselves *prime causes.* The combustion of coal in the furnace of a locomotive, and the eruption of a volcano, the zephyr that fans the cheek on a summer's day, and the tornado that sends a fleet laden with humanity beneath the remorseless waves, the rounding of a tear, a pebble, and the formation of a world, the motion of a feather in the air, and the majestic march of a planet through space, the folding of the leaf of a sensitive plant, the movements of a zoophyte and the thoughts of man, are all and equally subjected to invariable laws. These laws are never changed nor suspended either to promote the welfare or to increase the suffering of man. The thunderbolt strikes whatever is in its course, whether it be the cottage of an honest peasant or a den of vice and crime. All our observations teach us that nature acts in accordance with laws, or in other words, we observe certain modes of action, or sequences of motion, and having learned by experience that these are uniform we call them "laws of nature."

Let us see what our finite senses can contribute to the proof of the existence of God. It is well known that all our senses have only a certain narrow range, within which they are able to bring us into sensible contact with the world about us.

All outside this range we are unable to reach. For example, we do not see all forms and colors; we do not hear all sounds; we do not smell all odors, we cannot consciously touch all substances, we cannot taste all flavors.

Vision depends on the wave motion of light. The length of a wave of mean red light is about $\frac{1}{39000}$th of an inch, that of violet $\frac{1}{57500}$th of an inch. But the number of oscillations of ether in a second, necessary to produce the sensation of red are 477,000,000,000,000, all of which enter the eye in one second. For the sensation of violet, the eye must receive 699,000,000,000,000 oscillations in one second, as light travels 185,000 miles in one second, travels so that in 52 minutes and 8 seconds it could move around the orbit of the earth. It requires, however, 498 seconds to travel a distance equal to that from the sun to the earth, and three years from the nearest star to the earth; while there are some stars the light from which must have been moving two million years to reach us. When waves of light having all possible lengths act on the eye simultaneously the sensation of white is produced. Without eyes the world would be wrapped in darkness, there being no light and color outside of the eye.

That there are vibrations of ether on each side of the red and the violet, each side of our limits of vision cannot be doubted; and if our eyes were sensitive enough to receive them, we could have the sensation of some color, which must under present conditions remain forever blank. The owl and bat can see what we cannot see, their eyes can receive oscillations of ether which pass by without affecting us. By means of lenses used in telescopes we have been able to collect a greater number of rays of light. Thus with a two-inch aperture the number of rays collected is 100 times as great as is collected by the naked eye, with a twenty-six-inch aperture the ratio is 16,900 to 1. Still, with artificial applications there are limitations. So with sound, which is a "sensation produced when vibrations of a certain character are excited in the auditory apparatus of the ear." The longest wave which can give an impression has a length of about 66 feet, which is equal to 16½ vibrations per second; when the wave is reduced to about three or four tenths of an inch, equal to from 38,000 to 40,000 vibrations a second, sound becomes again inaudible. The piano, for instance, only runs between 27½ vibrations in a second up to 3,520. Sound travels about 1,093 feet per second, and the human voice can be heard 460 feet away, whilst a rifle can be heard 3.02 miles, and very strong cannonading about 90 to 100 miles. That there are vibrations above and below 16½ and 40,000, there is no reason to doubt, as there exist animals who have ears which can be affected by them, such as the hare; but to us they are as though they did not exist. Of all our senses the sense of smell is the most acute. Valentine has calculated that we are able to perceive about the three one-hundred-millionth of a grain of musk. The minute particle, if such it be, which we perceive by smell, no chemical reaction can detect. Spectrum analysis can only recognize the two-hundred-millionth of a grain of soda. But this sense in man is far surpassed by the hound.

Our sense of taste is also limited; as has been already said, we cannot detect all flavors. We can recognize by taste one part of sulphuric acid in 1,000 parts of water; one drop on the tongue of this would contain $\frac{1}{2000}$th of a grain of sulphuric acid. The length of time needed for reaction in sensation has been determined by Veritschgau and Hougschmied, and in a person whose sense of taste was highly developed the reaction time was, for common salt, 0.159 second; for sugar, 0.1636 second; for acid, 0.167 second; and for quinine, 0.2351 second.

Reviewing, then, the above, it is evident there are eyes which can see what we cannot, there are ears which can hear what we cannot, and there are animals who can smell and touch what we cannot. There is therefore a world of information outside of our finite senses, which we know exists, yet our finite senses are unable to detect. It is impossible to make a person understand anything which is entirely unlike all that has ever been seen or heard, for every idea in the world that man has has come to him by nature. Man cannot conceive of anything the hint of which has not been received from his surroundings. He can imagine an animal with the hoof of a bison, with a pouch of a kangaroo, with the wings of an eagle, with the beak of a bird, and with a tail of a lion, and yet every point of this monster he borrowed from nature. Everything he can think of, everything he can dream of, is borrowed from his surroundings—everything.

So if an angel should come and tell us of the infinite: of God, his description would mean nothing, unless we could translate it into terms of our own experience. For the finite cannot comprehend the Infinite. Our ignorance is not even then a probability against our belief.

All of the so-called matter of nature acts according to laws. The question naturally arises, What is this material of which the universe is composed? In other words, What is matter? Tyndall was asked what is mind, and what is matter? and he answered, "Mind is not matter, and matter is never mind." It certainly was no matter what he said. The true and only definition of matter is—Force. For if matter were not force it would be unthinkable, it could not be known at all, could not be rationally inferred; being force it becomes thinkable. The operation of force could furnish no evidence of the existence of forceless matter. If force is not matter, then force can exist and operate without matter; its existence and operation are no evidence of the existence of matter. And as matter is forceless it can itself give no evidence of its own existence, for that would be an exercise of force. If force cannot exist and operate without matter, then force depends for its existence and operation on the forceless, which destroys itself, or force depends for its existence on matter as some property or force, and so matter and force are identified, and force depends on itself only as it must. Any existence outside of ourselves capable of making an impression may be called matter or force in one form or another. To the constant impressions we receive, through motion, modification of their duration, intensity, and separation, we have for convenience given names, as the boundaries of the existences making the impressions thus becomes known.

Science has demonstrated the indestructibility of matter; it is eternal and imperishable. "The creation of matter," says Haeckel, is completely beyond human comprehension, and can never become the inquiry of scientific investigation, and if science makes the 'history of creation' its highest, and most difficult, and most comprehensible problem, it must deal with '*the coming into being of the form* of natural bodies.'

Experience has never shown that even the smallest particle of matter has come intoexistence or passed away.

If matter and force are one, what has science proved in relation to force? Science has likewise demonstrated the indestructibility of force, as also the unity of all the forces. All the forces of nature are mutually convertible one into the other, and there exists a mutual dependence and relationship between them. The fact of force correlation has been pronounced the most important discovery of the present century. Heat may be said to produce electricity, electricity to produce heat; magnetism to produce electricity, electricity to produce magnetism, and so on for the rest.

Science, then, has proved the unity of force and its indestructibility, as also the indestructibility of matter; can we not also prove the unity of matter, and if so, we can safely proclaim the unity of matter and force. For if matter were not force, and immediately known as force, it could not be known at all, could not be rationally inferred.

It is true that at the present moment sixty-eight forms of matter exist which have refused to be decomposed by all the processes known to science. These bodies are called elements, in contradistinction to compounds. The fact that the physical properties of matter would disappear in the isolated atom, and are only produced by the aggregation of atoms, is a very strong argument for both the unity of matter and the unity of matter and force. Elements can only be examined in a state of aggregation and only through those forms of energy—heat, light, electricity, magnetism, chemical affinity, etc.—which are mutually convertible, and which have been received as the exponents of the inbeing qualities of the elements; or by means of those energies—color, weight, hardness, taste, fusibility, etc.—which disappear with the disintegration of the mass into its final units. All of the complex properties of matter proceed from a primary attractive energy. To the separation and expansion of the atoms of matter, or, in other words, concentrated nuclei of force, is due all the phenomena of light, heat, electrical and magnetic effects, chemical energy, and vital force.

We reduce matter and force to a unity, which all nature proclaims. The idea that force is only an attribute of matter, and inherent in it, is absurd, for there is not a shadow of evidence that force is or can be an attribute of matter. Force is therefore matter itself, and its various manifestations are simple correlated manifestations of itself.

"Regularity and harmony can be universal only on the ground of one controlling principle."

Elements are not essences which can be definitely distinguished by appearance, smell, or taste; the property which alone positively distinguishes one element from another is weight. All we know of the composition of matter is based on this fundamental principle, that weight is the true measure of quantity of material, which is simply the first postulate of the law of gravitation. Let us then direct our attention to this great law. What, then, is weight? Why, it is nothing more than the measure of the force with which bodies are drawn toward the earth. At the centre of the earth weight disappears, as a body on the surface which weighs 1,000 lbs. weighs nothing at the centre, and if elevated above the earth would weigh less than one grain at a height of 11,000,000 miles; or a body weighing 1 oz. at the surface of the earth will weigh less than 1 grain 80,000 miles above its surface. Whilst theoretically a body will weigh something at any distance from the earth's surface, yet the weight will be so small, such a minute fraction of a grain, that it will practically weigh nothing at a great distance. If the earth revolved seventeen times as fast as it does, the centrifugal force at the equator would counterbalance gravity entirely, and thus deprive all bodies of weight.

The force of gravity at the earth's surface is represented by 32, on the surface of Jupiter it is represented as 78, which means that in one second a body allowed freely to fall would attain a velocity of 78 feet in one second. Bodies weighing 1 lb. on the surface of the earth would weigh on the surface of Jupiter 2½ lbs., and since the sun weighs 330,000 times as much as the earth, a body weighing a pound on the earth's surface would weigh 27.71 lbs. on the surface of the sun. At the earth's surface in vacuum bodies fall 16 feet in one second, at the distance of the moon, 240,000 miles, they would fall only one-eighteenth of an inch a second. It is the attraction of gravitation which keeps the moon in her path around the earth, and all other planets in their orbits, and the same law of gravitation holds good with the most distant star. If our earth were suddenly stopped in its orbit, the heat generated would raise an earth of lead of the same magnitude to a temperature of 384,000° Cent. Placing a body at the extreme limit of the earth's attractive influence, it would obtain a maximum velocity of 7 miles per second in falling toward it; and similarly situated with respect to the sun, it would attain a velocity of 390 miles per second. In the first case, the heat developed by the collision—supposing no loss—would be twice the quantity attending the combustion of an equal weight of coal; and in the second case, it would be more than three thousand times this amount, or equal to 29,000,000° Cent. of heat.

If we calculate the density of the mass of our planetary system according to the assumption that it was once a nebulous mass extending to the orbital path of the outermost planet, we should find that it would require several cubic miles of such matter to weigh a single grain. In the infinity of matter and space there is no absolute centre of gravity, for there is no circumference. The centre of gravity of the solar system is very little outside the body of the sun, and when Jupiter and Saturn are in opposite directions the centre of gravity is inside of the sun. The star Alcyone in the Pleiades, is supposed by many astronomers to be the mightier sun which forms the centre of unity for our own sun and a great number of other solar systems, and there can be little doubt that the Milky Way, composed of at least 18,000,000 stars, has some vast centre around which Alcyone and all the other stars of this immense cluster make their almost infinite circuit. It is the attraction of gravitation which binds the whole physical universe into oneness of law and oneness of existence, and is everlastingly bringing all bodies toward some central point by its infinite chains of power. This attraction of gravitation, according to the demonstrations of Laplace, moves millions of times as swiftly as light, and yet is so mighty as to float all worlds on its breath, and is so exquisitely gentle as to yield to a mote in the sunbeam.

Let us now direct our attention to the power which man possesses in making the laws of nature subservient to his wishes.

He can and daily does practically overpower her laws, or seemingly make them obedient to his desires.

There is nothing in the whole earth which he has not subdued, or does not hope to subdue, to his use. There is hardly a physical miracle which he does not feel he can or may perform. But all this wonderful, this boundless power over material laws is gained by the laws. He alters no property of matter, but he uses one property or another as he needs, and he uses one property to overpower another. As Professor Boyd has said, " He subdues nature by understanding nature. He creates no property; he therefore performs no miracles, though he does marvels." Miracles are overthrown from the fact that science proclaims the conservation and correlation of the forces.

Despite the laws of gravity man ascends to the sky in a balloon; he makes water spring up in fountains; he makes vessels, weighing thousands of tons, float on the seas. It is by knowing that gravity is more powerful in the case of air than in the case of hydrogen gas, that he makes the air sustain him as he floats beneath a bag of hydrogen above the earth. It is by knowing that gravity is more powerful in water than in air that he sails in iron ships.

Despite cohesion, he grinds rocks to powder; despite chemical affinity, he transmutes into myriads of different forms the few elements of which all matter exists; despite the resistless power of the thunderbolt, he tames electricity to be his servant or his harmless toy. With water and fire he moulds into shape mighty masses of metal; he shoots, at a sustained speed beyond that of birds, across the valleys and through mountain ranges; he unites seas which continents had separated. It is by knowing chemical affinity or repulsion that he makes the compounds or extracts the simple elements he desires; it is by knowing that affinity is force, and that force is transmutable into electricity, that he makes a messenger of the obedient lightning shock; it is by knowing that heat, itself unknown, causes gases to expand, that he makes machines of senseless iron do the work of intelligent giants.

Let us ask now what Americans have contributed? The answer is that there is hardly an industry to the progress of which Americans have not largely contributed. The cotton-gin, without which the machine-spinner and the powerful loom would be helpless, is American. The power-shuttle, which permits an unlimited enlargement of the breadth of the web, is American. The planing machine is American. Navigation by steam is American. The mower and reaper are American. The rotary printing-presses are American. The hot-air engine is American. The sewing-machine is American. The machine manufacture of wool-card is American. The whole India-rubber industry is American. The hand-saw originated in America. The machine manufacture of horseshoes is American. The sand-blast is American. The gauge-lath is American. The first successful composing machine was American. The type-writer is American. The grain-elevator is American. The first process for the artificial manufacture of ice was discovered by Professor Twining, an American. The telephone, which is of so much practical value, was discovered by an American. The phonograph, invented by Edison, is American. The tassimeter, which measures the heat of the stars, was discovered by Edison, an American. The electro-magnet was invented by Professor Henry, an American, and was first practically applied in transmitting telegraph signals by him. The telegraphic instrument, invented a few years later, and which has been universally adopted, was invented by Professor Morse, an American. The system of duplex and quadruplex telegraphy is American, and is a discovery than which the history of mechanical progress knows no greater triumph.

Numerous other applications of the laws of nature by Americans could be cited, but those already stated will serve to illustrate the great inventive genius of the American people as well as their comprehension of nature's laws and their power to make them serve their uses, always, however, subduing or overpowering one law by the exercise of another.

We have seen that all nature is governed by immutable law, and surely the Infinite God is not lowered by estimates through law instead of personality.

Immutability is an attribute of perfection, mutability of imperfection.